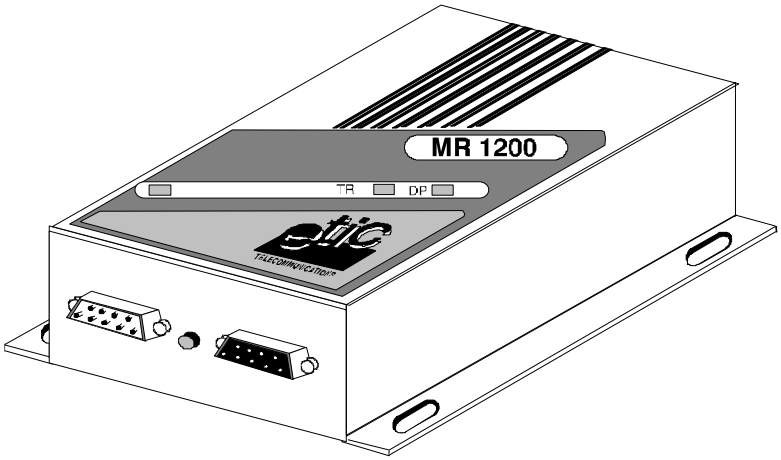

MR1200

RADIO MODEM 1200 bauds

USER MANUAL

908709-02

(AUGUST 2000)

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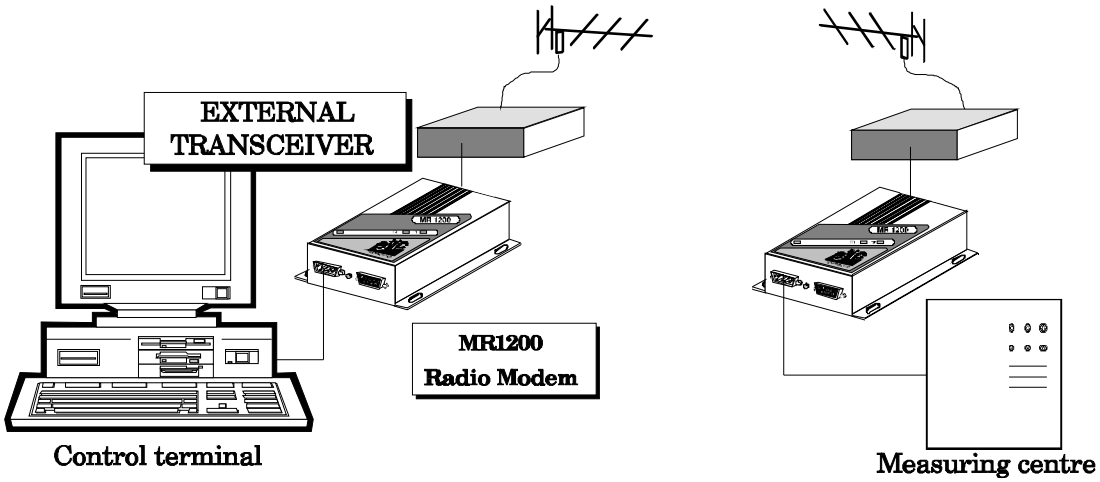
1. INTRODUCTION

The MR1200 modem is designed for half duplex data communication over a radio-frequency channel.

Connection is made to an external VHF or UHF transceiver.

The MR1200 exists in 2 versions:
- 1200 b/s version.
- 2400 b/s version.



The general features of the MR1200 are :

- **Half duplex data transmission** : synchronous data transmission using FFSK modulation at 1200 b/s or 2400 b/s, plus data protection using an error correction code.
- **RS232 or RS485 serial link** to the Data Terminal Equipment, with a choice of command modes including 3-wire "automatic" mode (TxD, RxD, ground) in RS232 mode.
- **15-way sub-D** connector for connection to the external transceiver .
- **Radio channel access conflict management :** multiple equipment using the same radio channel.
- **Microphone/loudspeaker set -** optional.
- **Possibility exists to selectively address** a radio relay conforming to CCIR or ZVEI standards.

- **Minimal power consumption** of 50 mA, reduced to 300 µA using the power saving feature.
- **Durable and compact case** housing the data handling/interface card.
- **Completely configurable** from an ASCII terminal, using an elementary set of commands.

2. INSTALLATION

2.1. Preamble

The MR1200 has an IP40 protection index. For outdoor installation therefore it will be necessary to site the modem, transceiver, Data Terminal Equipment, battery and any temperature regulating devices in a clean, dry enclosure.

2.2. External description

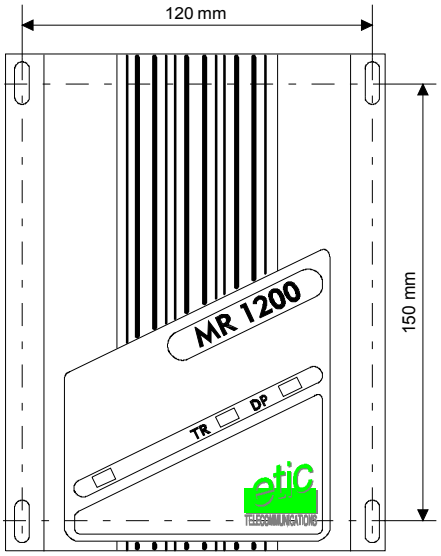
The MR1200 modem is housed in a metal box.

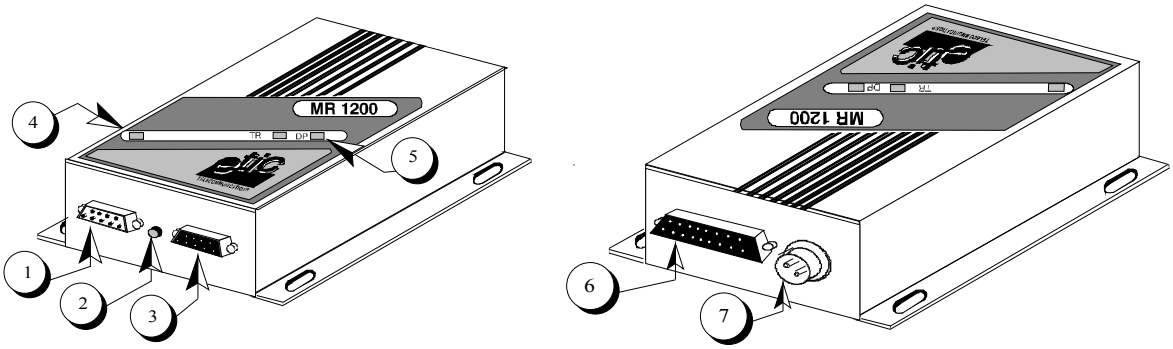
Dimensions: 180 x 130 x 45 (L x W x H)

Overall weight : 550 g

Impact and penetration : IP40

Fixing centres :

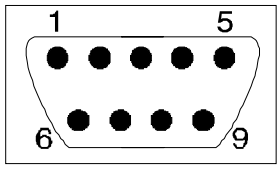




1 : Serial connector to data terminal (male 9-way sub-D).
2 : Miniature push-button switch to enter configuration mode.
3 : RS485 serial link or Microphone / loudspeaker connector, optional (reference MIC-02)
4: Power indicator.
5 : Radio transmission (TR) and reception (DP) indicators.
6 : External transceiver connector (female 15-way sub-D).
7 : Power connector (10 to 16 Volts).

2.3. Connecting to the terminal

The MR1200 dialogues with its command terminal over an RS232 (+12V/ -12V) serial link. The connector used is a **male, 9-way sub-D** whose pinout is as shown :



The different circuits carried on the interface are shown in the following table :

Pin	Circuit	Function	Usage according to control mode		
			automatic	direct	V25bis
1	109-DCD	Detection of modulated carrier	optional	optional	optional
2	104-RxD	Data reception	yes	yes	yes
3	103-TxD	Data transmission	yes	yes	yes
4	108/2-DTR	Wake-up / V25bis dialogue	optional	optional	yes
5	102-SG	Signal ground	yes	yes	yes
6	107-DSR	Radio communication underway	optional	advised	yes
7	105-RTS	Send command - in direct mode	-	yes	-
8	106-CTS	Clear to send (flow control)	advised	yes	yes
9	125-RI	Received call indicator - V25bis mode	optional	optional	optional

Remarks :

- The command data terminal can be any type as long as its serial interface can function with the following speeds and transmission formats :

speed : 150, 300, 600, 1200, 2400, 4800 or 9600 bits/s

format : 7E1, 7O1, 7-2, 7E2, 7O2, 8-1, 8E1, 8O1, or 8-2

- In practice, RS232 cables should be no longer than 15 metres. If the installation is exposed to electrical or radio disturbance reduce cable lengths to a minimum.

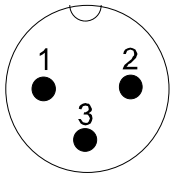
2.4. Choice of radio channel data transmission rate

As standard, the modem uses a 1200 baud radio channel data rate. It can also be factory configured to work at 2400 baud.

2.5. Power supply connection

The MR1200 needs a d.c. power supply voltage of between 10.6 V et 15.8 V. When used on an isolated site a 12V lead battery is an ideal solution.

The MR1200 is fitted with a circular, male, power supply connector whose pinout is as shown :



1 : +12 V

2 : ground

3: not connected

Remarks :

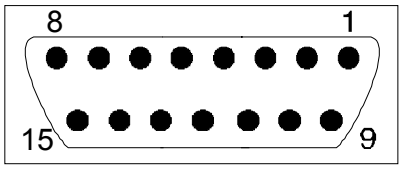
- The MR1200 does not possess an ON/OFF switch.
- The MR1200 works from a single source of power. Where two power sources are used (battery + solar panels, for example), switching between them must be done externally.

2.6. Connecting to the transceiver

The MR1200 has been designed to be connected to different types of VHF or UHF transceivers (T/R). Connecting to a T/R does, however, require level adjustments to be carried out, and sometimes changes to be made to the circuit board.

2.6.1. Description of the LF interface signals

For the radio link the MR1200 uses a **15-way sub-D** connector whose pinout is shown below:



9	LFout	: LF transmit output
11	$LFin^-$	: main LF receive input
10	$LFin^+$	: secondary LF receive input (for differential input mode)
1 (, 2, 3)	ALT	: half duplex control
12	DP	: radio carrier detect, or squelch inf. (optional)
6	V_{REG}	: Output for T/R power supply relay control
5	GND	: T/R signal ground
8	GND	: T/R signal ground
14	+ 12 V	(reserved for modem card power supply from the transceiver)
15	O V	(reserved for modem card power supply from the transceiver)
7		: reserved
13		: reserved
4		: reserved

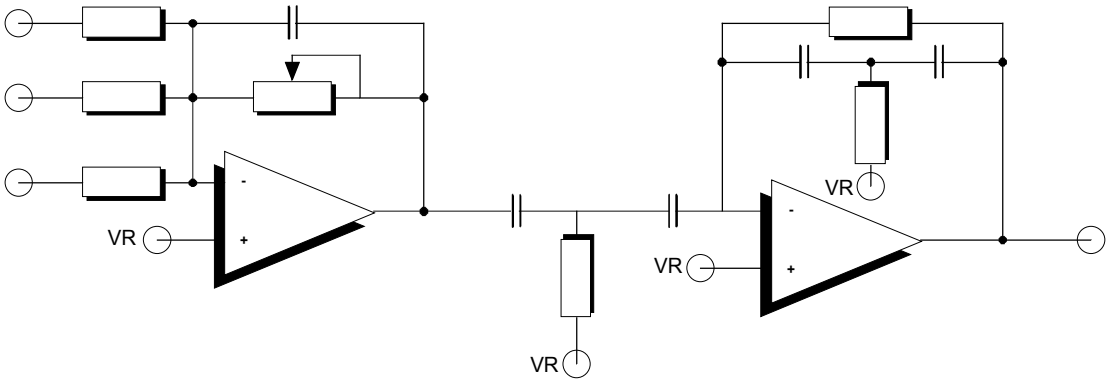
2.6.1.1. The LFout connection

The output stage levels are calculated to match the VCO input of a classic analogue phase modulated transmitter.

The circuit diagram below shows :

- an amplification stage (IC3-A + R25 + P3) with gain adjustment using the multiturn potentiometer (P3).

- a signal pre-emphasis stage (IC3-B + C17, C15, C3, C4 + R19, R11, R12), providing the correct levels at the VCO input to obtain the frequency excursions recommended by the ST/PAA/DIR/1382 standard.

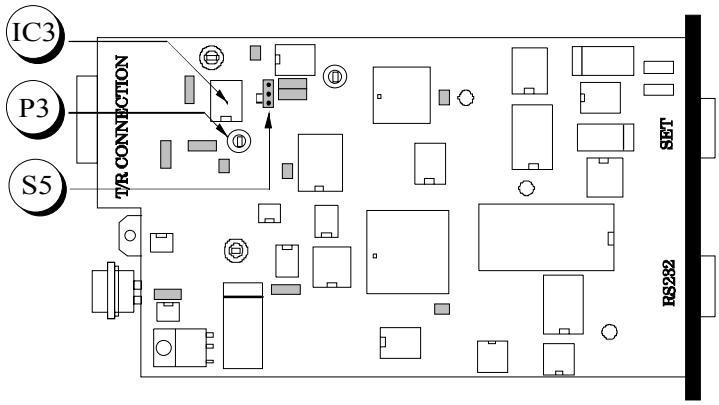


modulating signal	radio frequency excursion	Tolerances
f_0 = 1800 Hz	Δf_0 = 1.57 kHz	+0.2 kHz / -0.32 kHz
f_1 = 1200 Hz	Δf_1 = 1.04 kHz	+0.13 kHz / -0.21 kHz

The pre-emphasis stage is in fact a 2nd-order high-pass filter defining the following relationship :

$$\Delta f_1 = \frac{\Delta f_0}{1.5} \pm 0.12 \text{ kHz}$$

If the transmitter used has an input marked « external mic », it is quite likely that pre-emphasis is already provided at the input stage. In this case, it is possible to bypass the modem pre-emphasis stage by moving jumper S5 as shown below.



Potentiometer P3 then enables the level of the T/R input signal to be set so that the recommended frequency excursions Δf_0 and Δf_1 can be obtained.

P3 is factory set for a signal of 175 mV r.m.s. at 1200 Hz, and 265 mV r.m.s. at 1800 Hz.

Depending on the type of microphone specified for the equipment, the T/R manufacturer may have used filters having responses that could upset data transmission.
In this case, a complete transmitter frequency response spectrum will be required in order to determine the characteristics of any compensating filter needed to obtain the recommended radio channel frequency excursions. The discreet components around IC3-B may be changed to achieve the correct filter response.

This is a delicate operation requiring radio frequency measuring equipment and an SMD soldering kit (see ETIC).

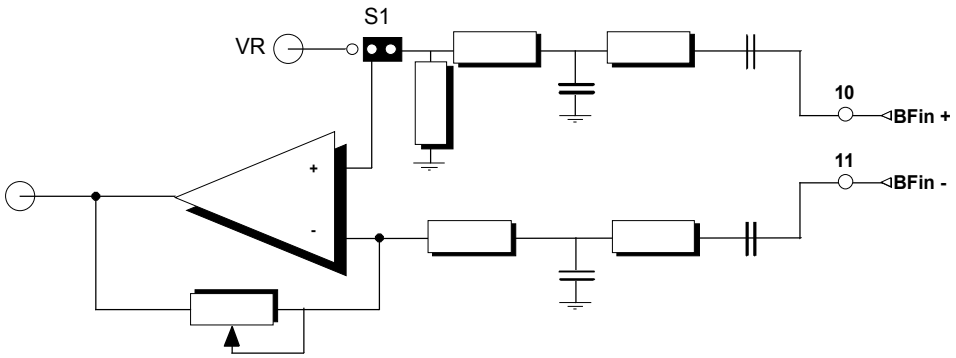
2.6.1.2. The LFin connection

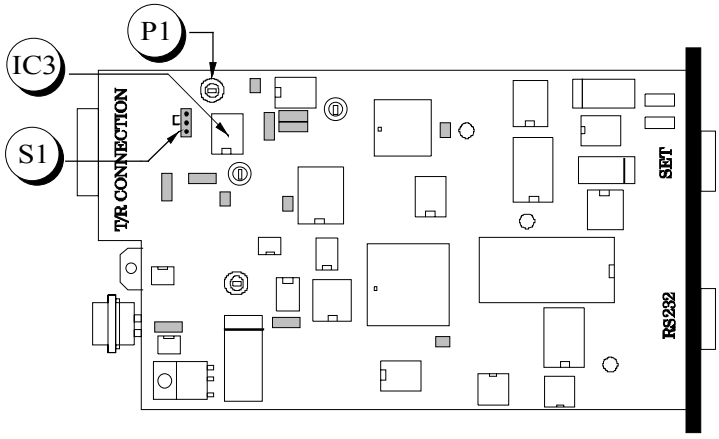
The demodulated signal input stage consists of :

- a passive band-pass filter (C12 + R8 + C14)

- an amplification stage(IC3-C + R4 + P1) with gain adjustment using the multiturn potentiometer (P1).

The high input impedance means the LFin input stage will accept signals from the « audio » or « external loudspeaker » outputs of most T/Rs.
Where the T/R has a differential output, the network (R9 + R10 + R15 + C9 + C15) allows such an output to be connected. In this case strap S1 must be moved. Where possible, it is preferable to use the differential mode configuration since it reduces noise.

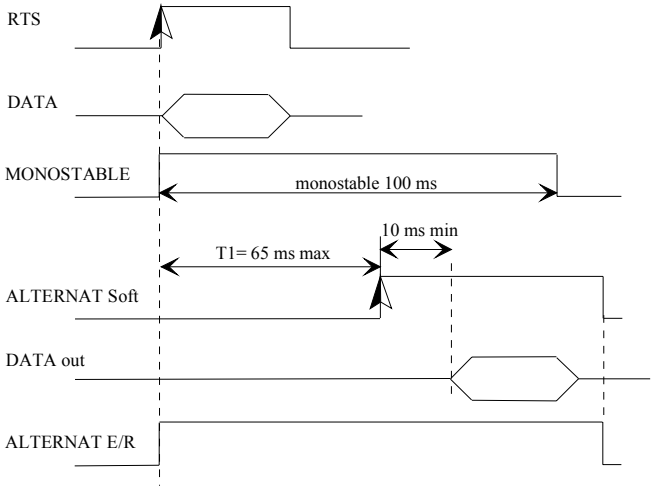




The operation requires the copper track (component side) linking the S1 pins to be cut, and a strap soldered in position as shown above.
P1 is factory set to give an RX level of 460 mV r.m.s. when a signal of 1500 Hz / 85 mV r.m.s. is applied to the LFin input.

2.6.1.3. The ALT connection

The T/R 's change over to transmit mode (ALTERNAT command) either happens the instant circuit 105-RTS is set ON, or when the ALT command generated by the data card is asserted .
A monostable triggered by 105-RTS prevents T/R changeover occurring before data transmission has terminated.



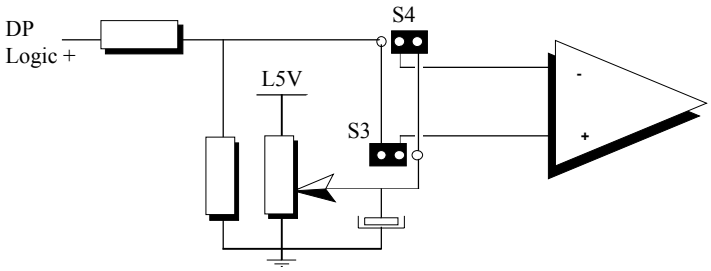
2.6.1.4. The DP connection (optional)

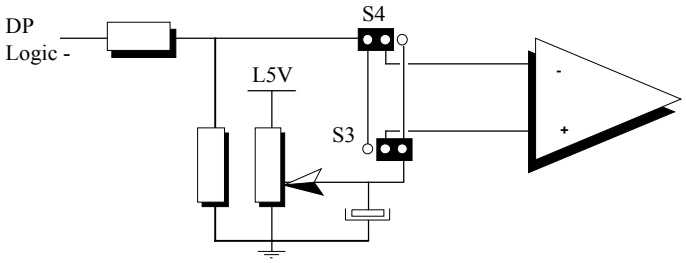
In order to avoid collisions, the data card uses the DP signal (carrier detect, or squelch-inf.) to check the radio channel status before transmitting data.

Not all T/Rs provide a carrier detect /squelch output signal, and in such cases the MR 1200 configuration need not take account of this input.

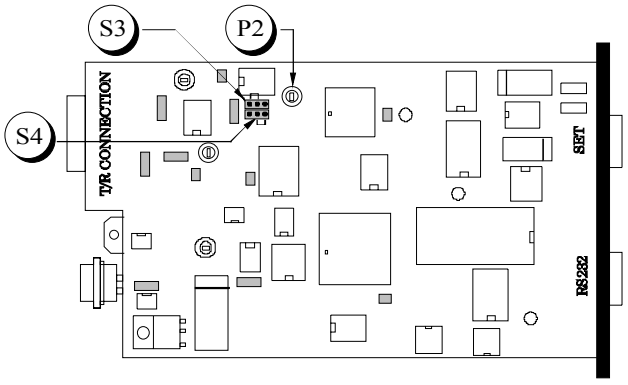
To generate its «Channel occupied» logic signal the modem compares the DP signal from the transceiver with a threshold voltage (IC1 + R7 + R20 + R22 + P2 + C6).

The threshold level is adjusted with P2.
Using straps S3 and S4, a positive logic level can be generated whatever the nature of the DP signal input.





Straps S3 and S4 are factory set for a positive DP signal. In the opposite case, straps S3 and S4 need to be altered. Once the copper tracks (component side) connecting the S3 pins and those between the S4 pins have been cut, straps are soldered into position as shown below.



2.6.2. The type of connecting cable to use

The connection between the MR1200 and the transceiver must be made using a short length of multicore screened cable.
The screen should be connected to the metal shell of the 15-way sub-D connector.

2.6.3. Factory pre-setting

ETIC can deliver modems pre-configured for the chosen transceiver. Interconnection wiring sheets have been produced for most models of transceiver on the market.

When ordering :
- specify the make and type of transmitter
- include the FR02 option in the order (modem set-up)
- if the transmitter details are not known to us, option FR03 should also be ordered (transmitter connection investigation) and 2 units with manuals forwarded which will enable a connection and line up adjustment sheet to be drawn up.

2.6.4. Particularity of the 2400 b/s version

FFSK modulation at 2400 b/s

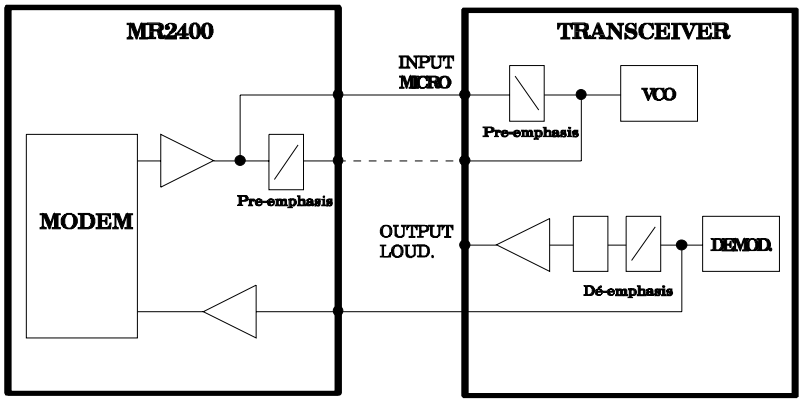
For FFSK modulation at 2400 b/s, the sub carriers coding bits 1 and 0 are respectively F1 = 1200 Hz and F0 = 2400 Hz.

Now, 2400 b/s is at the limit of the transmission chain bandwidth, and any mismatching tolerable at 1200 b/s will now produce signal alterations too severe for the modem to handle. Furthermore, in order to maintain the bit rate, modulation frequency shifts at crossover take place every quarter cycle, making the modem more sensitive to signal phase errors.

For transmission : it is advisable to ensure that only one pre-emphasis filter is used : either by taking the modem output directly to the T/R VCO, or by strapping out the modem filter and using the filter on the transceiver microphone input (different modulation index),.

For reception : it is imperative to have access to the demodulator output signal directly before the de-emphasis stage, thus avoiding the different LF stage filters in the receiver which alter the signal too much to enable data reception to be error free.

Connection block diagram



2.7. Power saving feature set up

The power saving feature, not operative when the modem is in its normal "awake" state, comes into operation when the unit is "asleep". Three jumpers on the data card need to be positioned to configure the different wake-up modes.

There are two possible sleep modes :

- **SLEEP MODE 1 :** MR1200 asleep, T/R awake.

  Wake up initiated by 108/2-DTR, by radio CD or by the configuration mode push-button being activated.

- **SLEEP MODE 2 :** MR1200 asleep, T/R not powered.
  In this case, power for the T/R is supplied through a relay controlled by the MR1200. Relay operation is described in chapter 4.5.3.

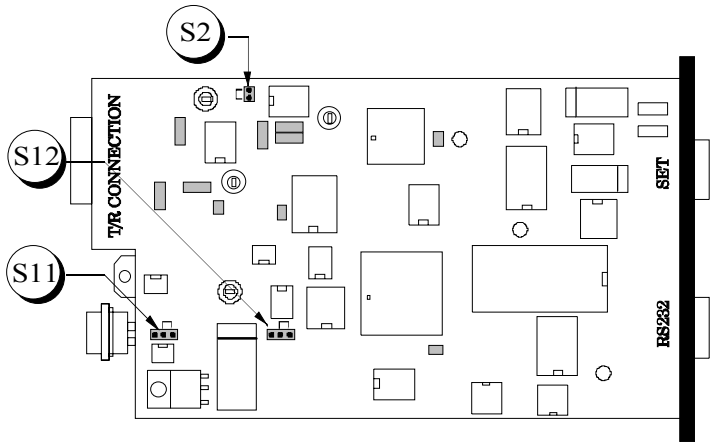
  Wake up initiated by 108-DTR or by the configuration mode push-button being activated.

Configuring the straps for **SLEEP MODE 1 :**

Cut the copper track linking the pins of S12 (component side) and solder a strap in position as indicated on the drawing below.
If it is desired to confirm modem wake up through the radio CD, solder a strap on S2 as indicated on the drawing below.

Configuring the straps for **SLEEP MODE 2 :**

Cut the copper tracks linking the pins of S12 and of S11 (component side) and solder a strap in position as indicated on the drawing below.



2.8. Connecting the optional microphone + loudspeaker set

A set compatible with the MR1200 is available, having reference **MIC-02**.

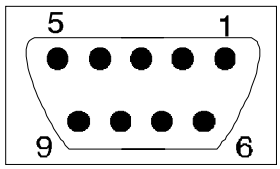
2.8.1. Description of the microphone/loudspeaker interface

The demodulated signal is amplified (circuit around IC3-D and IC5) in order to directly drive a 4 Ω loudspeaker.
Warning : the LS output signal is referenced to +5V. The loudspeaker must therefore be connected between the HP and V+ (+5V) outputs available on the female 9-way sub-D connector.

For a signal of 1500 Hz / 85 mV r.m.s. applied to the LF_{in} input - (transceiver interface), the power delivered to a 4 Ω LS is approximately 25 mW.

If the set used incorporates amplification (i.e. has a high impedance input), better audio quality can be obtained by taking the LS signal directly from the output of IC3-D (behind C8), and if necessary increasing the level by modifying the values of R3 and R17 (consult ETIC).

The pinout of the female 9-way sub-D connector is as shown :



1, 5	:	+5 V (cut when the MR1200 is in sleep mode)
2	:	LS output
3	:	microphone input
4	:	transmit control o/p (PTT: connected to pin 5 for transmit)
6	:	ground
7	:	D- RS485
8	:	RS485 Adaptation (to adapt impedance of the RS485 serial link by connecting pin 7 to pin 8)
9	:	D+ RS485

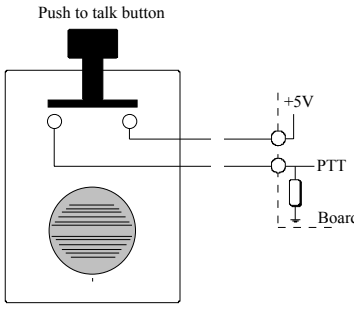
The interface was designed for a particular microphone/LS set, for sale under reference «MIC-02». Using another kind of set may necessitate modifications to some of the discreet components on the card.

2.8.2. PTT connection (push to talk)

The MR 1200 needs a TTL logic signal to control the T/R changeover to transmission :

- 0V : wait (reception)
- +5V : transmission

The PTT signal is derived simply by closing a pair of contacts operated by the changeover button :



2.8.3. MICROPHONE connection

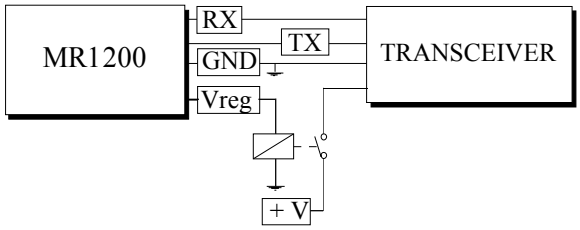
The external microphone signal is amplified and filtered (low-pass filter, IC3-A + C18 + R21 + P3 + C16).

If necessary, the signal level can altered by modifying resistor R21 (consult ETIC).

2.9. T/R power supply

The transceiver connected to the MR1200 should have an external power source.

For sleep mode operation the V_{REG} output can then be used to control a T/R power supply relay.



3. CONFIGURATION

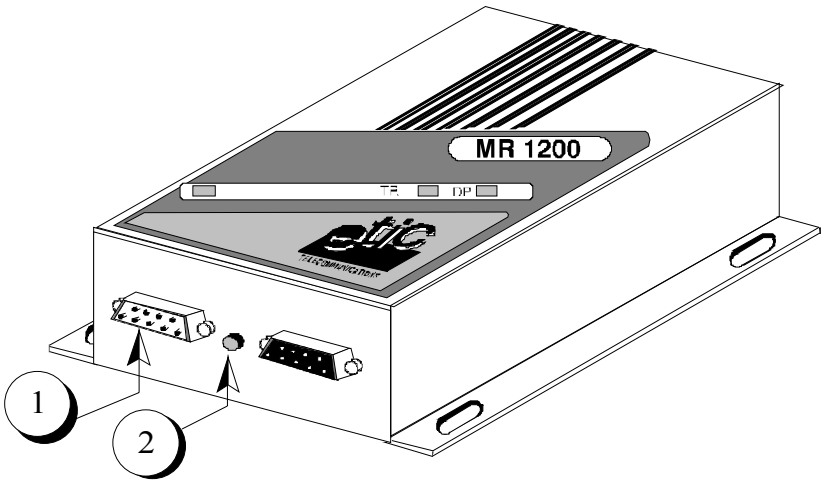
3.1. Entering configuration mode

Programming or listing the complete set of MR1200 operating parameters may be carried out using a data terminal connected via the serial interface.

The terminal must be set up with the following communication parameters :

- transmission speed 1200 bits/s
- transmission data format 7E1 (7 bits, even parity, 1 stop)

Once the terminal has been installed and the equipment powered, the operator pushes the "CONFIGURATION" miniature push-button found on the modem front panel
At this point, any radio communication in progress will be terminated, indicators TR and DP will come on and the following message will appear on the terminal screen : **C >**.



1 : Serial connector for terminal link (male 9-way sub-D)
2 : Miniature push-button switch selects configuration mode

3.2. Configuration commands

Operating parameters and options are programmed into, and read from, the MR1200's E2PROM memory using commands and responses as defined in the CCITT V25bis standard.

Terminal commands		Modem responses	
###	< erroneous command >	INV	Command invalid
PRP**ppp**;**vv...v**	Programme parameter **ppp** with value **vv...v**	VAL	Command accepted
RLP**ppp**	Read parameter **ppp**	LSP**ppp**;**vv...v**	Indicates value **vv...v** of parameter **ppp**
RLP P**n**	Read page **n** of the configuration (n = 1 or 2).	LSP**ppp1;vv...v** to LSP**pppn**;**vv...v**	Indicates value **vvv...v** for parameter **ppp1** to **pppn**.
RES0	Reinitialise terminal-modem dialogue	VAL	Reinitialisation carried out
RES1	Reinitialise modem using the default parameters	VAL	Reinitialisation carried out

Remarks :

- symbols shown by **p** represent ASCII numbers,
- the value **vv...v** of a parameter is given in the form of an ASCII chain ; coding depends on the parameter,
- all terminal commands must be composed of ASCII characters and terminated by the control code [Cr] (Carriage Return) or by the [Cr-Lf] (Carriage Return + Line Feed) combination,
- The MR1200 echoes all the commands it receives on the terminal screen. It is always possible to cancel this echo if the terminal echoes its keyboard input locally.

3.3. Quick configuration

This paragraph describes the minimum configuration necessary to get the modem up and running quickly.

When completed, the MR1200 will function in automatic mode (communication using 4 serial interface circuits : 103-TD, 104-RD, 106-CTS and 102-SG). The power saving feature will not be operative.

- Connect an ASCII terminal (type VT100, or a PC emulating VT100) to the MR1200 using a 4-wire cable carrying circuits 103-TD, 104-RD, 106-CTS and 102-SG of the RS232 serial interface.
- Apply power to both terminal and modem.
- Configure the terminal's communication port for 1200 bits/s, 7E1, no handshaking.
- Operate the miniature push-button "CONFIGURATION" switch on the MR1200 front panel. All modem indicators will then come on, and "**C>**" should appear on the terminal screen.
- Enter the command "**RES1**" followed by [Cr]. The indicators should go out.
- Operate the "CONFIGURATION" push-button switch once more to turn the indicator lamps on again and bring back the "**C>**" cursor.

- Enter the command "**PRP010;x**" followed by [Cr], where **x** is a number between 0 and 8 coding the data format that the MR1200 will use for communication with the terminal :

  x=0 : 7E1 (7 bits, even parity, 1 stop) **x**=5 : 8-1 (8 bits, no parity, 1 stop)

  x=1 : 7O1 (7 bits, even parity, 1 stop) **x**=6 : 8E1 (8 bits, even parity, 1 stop)

  x=2 : 7-2 (7 bits, no parity, 2 stops) **x**=7 : 8O1 (8 bits, even parity, 1 stop)

  x=3 : 7E2 (7 bits, even parity, 2 stops) **x**=8 : 8-2 (8 bits, no parity, 2 stops)

  x=4 : 7O2 (7 bits, even parity, 2 stops)

- Enter the command "**PRP011;y**" followed by [Cr], where **y** is a number between 0 and 6 coding the data rate the MR1200 will use for communication with the terminal :

  y=0 : 150 b/s **y**=3 : 1200 b/s **y**=6 : 9600 b/s

  y=1 : 300 b/s **y**=4 : 2400 b/s

  y=2 : 600 b/s **y**=5 : 4800 b/s

- If the MR1200 is to be used to transmit MODBUS/JBUS frames, enter the command "**PRP030;1**" followed by [Cr]. Now, use the "**RLP53**" command followed by [Cr] to check that when receiving data, the wait time is sufficiently long so as to not strip off these frames and thus inhibit block mode : "**LSP53;5**" (minimum).
- Operating the "CONFIGURATION" push-button one last time will turn off the indicators and disconnect the terminal.
- Connect the modem to one of the DTEs that will be using radio communication. The MR1200 will work with a 4-wire cable carrying the RS232 serial interface circuits 103-TD, 104-RD and 02-SG. A wire for the 106-CTS signal is optional - the modem uses this circuit for handshaking.

  Check which DTE serial interface loops are necessary for it to function correctly : most PCs, for example, require a loop between the 107-DSR and 08-DTR lines, plus the 106-CTS circuit to be wired.
- Prepare and install the other radio modems in the same way before running the application.

To read a modem's configuration quickly, use the "**RLP P1**" and "**RLP P2**" commands to provide a two-page listing of the settings.
Once configured, it is advisable to write down the modem settings in the "MODEM CONFIGURATION" table provided in the appendix.

3.4. Operating parameters and options

The following paragraphs describe the MR1200 configuration parameters in detail.

The default values for MR1200 parameters and options have a * next to them. These are the values assigned when the modem is first switched on or when the "**RES1**" command is sent.

3.4.1. Configuring the terminal-modem interface

Parameters 010 [f_v24] and 011 [v_v24]

These set the speed and data format of the terminal-modem serial link for normal operation (i.e. other than configuration mode).

f_v24	format
0 *	7E1 (7 bits, even parity, 1 stop)
1	7O1 (7 bits, even parity, 1 stop)
2	7-2 (7 bits, no parity, 2 stops)
3	7E2 (7 bits, even parity, 2 stops)
4	7O2 (7 bits, even parity, 2 stops)
5	8-1 (8 bits, no parity, 1 stop)
6	8E1 (8 bits, even parity, 1 stop)
7	8O1 (8 bits, even parity, 1 stop)
8	8-2 (8 bits, no parity, 2 stops)

v_v24	speed
0	150 b/s
1	300 b/s
2	600 b/s
3 *	1200 b/s
4	2400 b/s
5	4800 b/s
6	9600 b/s

Parameter 012 [mod_ter]

Defines the MR1200 control mode used for normal operation, from the 4 possible modes :

mod_ter	control mode
0	marked automatic
1 *	simple automatic
2	direct
3	V25bis

Either of the "automatic" modes is adequate in most instances, having been designed to allow the modem to operate transparently using only circuits 103-TD and 104-RD (and 106-CTS for handshaking if required).

In "direct" mode, the terminal uses an extra circuit (105-RTS) to control access to the radio channel before sending data.

The "V25bis" control mode uses all the serial interface signals - except 105-RTS - to give the terminal total control of the modem through a set of commands and responses corresponding to the V25bis standard. Where a number of radio modems are networked, individually addressed data messages can also be sent.

Parameter 013 [echo]

Enables or cancels the echoing of configuration commands (PRP/RLP) on the terminal screen. If the terminal already has local keyboard echo, it is advisable to set the value of this parameter to 0.

echo	config. echo
0	no
1 *	yes

Parameter 014 [mark]

Defines the ASCII control code for the character used to control data transmission in marked automatic mode (see **chapter 4**):

mark	format
from 0 to 255	BCD

* 013

A value of 013 is used to start transmission of a line of characters on reception of the [Cr] (Carriage Return) control character.

Parameter 015 [error]

When not null, the *error* parameter determines the code of the ASCII character sent to the terminal signalling reception over the radio channel of an invalid frame :

error	format
from 0 to 255	BCD

* 000

000 = used to cancel the signalling of invalid frames

Note: Should interference occur on the radio channel while the modems are synchronising, several frames may be lost without this fact being signalled to the terminal.

Parameter 016 [ges_dsr]

With this parameter set to 1, the RS232 interface 107-DSR circuit is implemented as per a standard telephone line modem : 107-DSR is ON during communication (radio channel), and OFF when at rest. Setting its value to 0 forces 107-DSR to the permanently ON condition.

ges_dsr	107-DSR handling
0	no (permanently ON)
1 *	yes (ON in communication)

3.4.2. Configuring the radio interface

Parameter 020 [mod_rad]

Defines the MR1200 data transmission mode :

mod_rad	transmission mode
0	simple mode(no CRC)
1 *	basic mode (with CRC)

Modem transmission normally operates in basic mode : the data is formatted into frames protected by the addition of a cyclic redundancy check code (CRC), resulting in a useful radio channel data rate of 900 b/s.

Simple mode should only be used over a good quality radio link (communicating stations relatively close) and when it is essential to have a useful radio channel data rate greater than 900 b/s. Data is transmitted with no extra coding and any errors are no longer filtered on reception.

Parameter 021 [tp_alt]

When the transceiver has been instructed to transmit, an initial time delay may be introduced before the first data message is sent, thereby allowing the RF stages to achieve nominal power :

tp_alt	units
from 0 to 255	x 10 ms

* 30 (=300 ms)

Parameter 022 [ges_dp]

Determines whether or not the carrier detect signal is used. The DP signal is derived from the receiver RF stages and indicates the current status of the radio channel :

ges_dp	DP implemented
0 *	no
1	yes

In the case of applications comprising several modems likely to transmit simultaneously (multi-master network, random access network), *ges_dp* should be implemented in order to limit radio channel collisions.
Where exchange of data is controlled by a master station (master-slaves network), this option may be deselected to reduce modem turn-around delay to a minimum.

Parameter 023 [st_num]

Allows selection of the MR1200 CCIR/ZVEI tone encoder operating mode :

st_num	standard
0 *	CCIR
1	CCIR short
2	ZVEI 1
3	ZVEI 2

Parameter 024 [seq_num]

Defines the tones to be emitted and/or the protocol used by the MR1200 each time it goes into transmit mode :

seq_num	format
Tone codes: '0' to '9', 'A' to 'E' Control codes: ': ? #> ! W ,'	Chain of 10 characters max.

* null chain

By default, the *seq_num* parameter is empty, the MR1200 simply testing the availability of the channel before transmitting any data.

In order to turn on and control the carrier of a CCIR or ZVEI relay, the *seq_num* parameter must be programmed with a chain of characters having the form :

'**?nn...n#>**' where **nn...n** is the relay's selective call number.

For more details on character chain coding for the *seq_num* parameter refer to **chapter 4** (**§4.4**).

3.4.3. Operating parameter

Parameter 030 [bloc]

For normal operation the *block* option is deselected, data being passed on to the terminal as soon as it has been extracted from the frames received over the radio link.
In *block* mode, data is stored until a complete message has been received, whereupon a block of data is passed on in an uninterrupted stream.

bloc	block mode
0 *	no
1	yes

Normal mode is the quicker option for modem to terminal data handling.
However, subject to testing, block mode may be selected when the terminal needs to have data presented in a continuous stream (as with MODBUS/JBUS data frames, for example).

Block mode is only possible when the modem is configured for 2400 b/s radio channel working.

Parameter 031 [ad_mod]

Each MR1200 modem on a transmission network can individually receive data by being allocated a unique address, notably when the "V25bis" control mode is used (see **chapter 4**).
The *ad_mod* parameter represents the individual modem's address :

ad_mod	format
from 0 to 255	BCD

* 0 (no address)

If 0 is entered for this parameter the MR1200 will not use an address when it transmits data.
To address data to stations within a transmission network, enter different, non zero addresses for each communicating station.

Parameter 032 [ad_dest]

Where a modem has been allocated an address (*ad_mod* parameter), the parameter *ad_dest* may be used to address data to a destination modem, when automatic or direct control mode has been set :

ad_dest	format
from 0 to 255	BCD

* 0 (no address)

If either the *ad_mod* parameter is null, or V25bis control mode is being used, the value of the *ad_dest* parameter is ignored.

Parameter 033 [phonie]

An optional microphone/loudspeaker set can be connected to the MR1200 for combined data and speech transmission working (see **chapter 2**).
In such a case, the *phonie* option must be enabled. Otherwise it is best to inhibit it :

phonie	speech transmission
0	Inhibited
1 *	Enabled

Parameter 034 [f_paq]

f_paq sets the maximum data packet size the MR1200 will transmit. The value set determines the frequency of the re-synchronisation sequences exchanged between the communicating modems (see **chapter 4**) :

f_paq	packet format
0	12 bytes
1	24 bytes
2	48 bytes
3	72 bytes
4	96 bytes
5	120 bytes
6 *	144 bytes
7	168 bytes
8	192 bytes
9	216 bytes
10	240 bytes

Select a small packet size (48 bytes or less) if transmission conditions are only mediocre.
Select a larger size (144 bytes or more) if the radio link is of good quality and the data rate needs to be high.

Parameter 035 [f_mem]

Alters the MR1200's transmit data buffer size from 32 bytes to 2 Kbytes depending on the application:

f_mem	buffer capacity
0	32 bytes
1	64 bytes
2	128 bytes
3 *	256 bytes
4	512 bytes
5	1024 bytes
6	2048 bytes

3.4.4. Power saving feature

Parameter 043 [att_ina]

This parameter determines the length of time after which the MR1200 goes to sleep once transmission and reception of data has ceased :

att_ina	format
de 0001 to 6000	MMSS
0000 *	unlimited wait

MM : minutes (2 ASCII numbers) SS : seconds (2 ASCII numbers)

The value 0000 prevents the modem from going to sleep.

3.4.5. Other parameters

Parameter 050 [tp_emi]

Fixes a limit to the length of the MR1200's transmission time, serving to avoid both a modem monopolising the radio channel and the risk of transceiver RF stages overheating :

tp_emi	units
from 1 to 255	x 1 s
0 *	no limit

A value of 0 removes all limits on the duration of transmission.

Parameter 051 [tp_sil]

A minimum period of post transmission silence can be defined, to allow other MR1200 modems the time to access to the radio channel :

tp_sil	units
de 1 to 255	x 1 s
0 *	= 6/20 x duration of transmission

The MR1200 ignores this parameter if no transmission time limit has been set (parameter *tp_emi* = null).

Parameter 052 [tp_ae]

Corresponds to the length of time the MR1200 will wait before ending radio transmission, once there is no more data to be sent :

tp_ae	units
de 0 to 255	x 20 ms

* 1 (=20 ms)

Enter a low value (20 ms) where applications function by a rapid exchange of data with brief request/response intervals.
Enter a higher value (100 ms or more) where : - data messages are long ; the control terminal's transmission speed is less than 2400 bits/s ; data flow is irregular.

Parameter 053 [tp_ar]

Represents the minimum MR1200 wait time before changeover to transmission, following radio channel data reception :

tp_ar	units
de 0 to 255	x 20 ms

* 1 (=20 ms)

Enter a low value (20 ms) where applications function by a rapid exchange of data with brief request/response intervals.

Enter a higher value (100 ms or more) where : - data messages are long ; the control terminal's transmission data rate is less than 2400 bits/s ; the flow of data is irregular

Parameter 054 [tp_rc]

Defines the MR1200 wait time before terminating the current communication in the absence of either data being sent or received :

tp_rc	units
de 0 to 999	x 50 ms

* 2 (=100 ms)

Enter a low value (100 ms) where applications function by a rapid exchange of data with brief request/response intervals, in automatic or direct control mode.
Enter a higher value (1 s or more) in V25bis control mode.

3.5. Leaving configuration mode

Once modem configuration has been completed, the operator activates the miniature push-button switch a second time to return the unit to normal operation.

The TR and DP indicators go out, and the modem serial interface is reconfigured with the speed and format parameters set by the operator.

Note : Should the operator leave the MR1200 in configuration mode, the unit will automatically revert to normal operation after 5 minutes.

4. OPERATION

4.1. Principle

Communication between MR1200 and control terminal takes place over the RS232 serial link. The modem then obtains access to the radio channel and finally sends the data to be transmitted.

- **Call control** :
  4 control modes enable the terminal to control the modem.
  The MR1200 then checks the status of the radio channel, turns on a relay if appropriate and finally transmits the data.

- **Data Communication** : Data transmission over the radio channel is half duplex. Communication between the modem and terminal is duplex.

4.2. Radio channel

4.2.1. Data transmission method

The MR1200 radio modem adheres strictly to the specifications laid down in the French standard ST/PAA/DIR/1382.

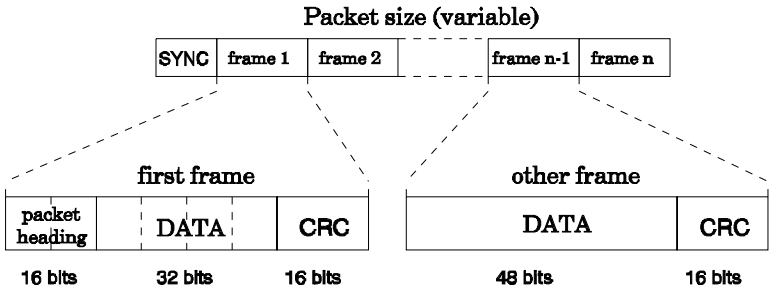
Radio channel data transmission is synchronous and uses a data rate of 1200 or 2400 b/s.
The modulation employed is of an indirect type : an FFSK modulated audio frequency sub-carrier phase modulates a radio frequency carrier.

Normal transmission is in « base mode » : data to be transmitted is formatted into frames protected by a cyclic redundancy check code (CRC), giving a useful radio channel data rate of 900 b/s.

Another transmission mode without CRC, called « simple mode », is also available but should not be employed unless the radio link is of good quality (communicating stations relatively close), and where a useful radio channel data rate greater than 900 b/s is essential. The data is transmitted without any extra coding and errors are no longer filtered out on reception of data.

4.2.2. Format and coding

The MR1200 assembles the data sent by its control terminal into packets of varying size depending on the amount of data.
The packets are themselves sub-divided into 64 bit frames, of which 16 bits are used for the cyclic redundancy check code (CRC) when in « base mode ».
Before being transmitted each packet is preceded by a sequence of bits whose job is to synchronise the two modems (SYNC).



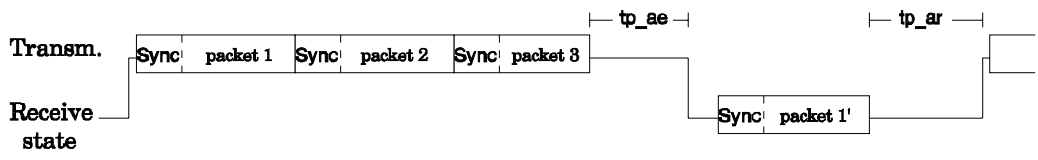
4.2.3. Operating conditions

radio channel access
At rest, the MR1200 permanently checks for activity on the radio channel ; a transmit command may simply be refused if the channel is occupied (absence of carrier for at least 0.1 seconds).

Half duplex timing
When transmission begins the MR1200 systematically delays sending the first data in order to allow transceiver RF stages to develop full power (*tp_alt* parameter).

Data packet size
Reducing or increasing data packet size will force the communicating modems to re-synchronise, the frequency depending on the application and the quality of the radio link (*f_paq* parameter).

Half duplex transmission
The MR1200 control of T/R switching (half duplex) is transparent to the terminal. The use of buffers enables terminal-modem dialogue to remain duplex throughout.
The modem will switch from transmission to reception according to a configurable timing parameter (*tp_ae* parameter), when there is no more data to be sent.
The MR1200 stays in the receive state while data is incoming, reverting to transmission at the end of a second configurable time delay if the terminal has new data (*tp_ar* parameter).



Received data restoration and error treatment (base mode)
The CRC of each frame received is tested, and frames with CRC errors are either eliminated or signalled using a configurable character (*error* parameter). The MR1200 extracts the data from each error-free frame, placing the bytes end to end.
The data is re-transmitted to the terminal either as it arrives, or as a block of data once the last frame has been received and restored (" block mode " option, *bloc* parameter).

Duration of data emission
The MR1200 will continue transmitting data for a limited period of between 1 and 255 seconds (*tp_emi* parameter), after which the modem will pause for a period also of between 1 and 255 seconds (*tp_rec* parameter) to allow other modems to gain access to the radio channel.
If transmission time limits have been set, long messages should be segmented and sent by the terminal in several batches, otherwise data may be lost.

modem memory capacity
The size of the MR1200's transmit buffer can be increased from 32 bytes up to 2 Kbytes depending on the application.

4.3. Modem control modes

4.3.1. The terminal-modem interface

The MR1200 dialogues with its control terminal across a standard RS232 serial interface.
The following table describes :
- the circuits comprising the serial interface
- their function
- their use according to the operating mode chosen.

Circuit	Name	Pin	Direction	Function	Control mode / implementation		
					automatic	direct	V25bis
102	SG	5		Signal ground	yes	yes	yes
103	TD	3	terminal->modem	Transmitted data	yes	yes	yes
104	RD	2	modem->terminal	Received data	yes	yes	yes
105	RTS	7	terminal->modem	Ready to send	-	yes	-
106	*CTS*	*8*	*modem->terminal*	*Clear to send*	advised	yes	yes
107	*DSR*	*6*	*modem->terminal*	*Data set ready*	optional	advised	yes
108/2	DTR	4	terminal->modem	Data terminal ready	optional	optional	yes
109	*DCD*	*1*	*modem->terminal*	*Carrier detect*	optional	optional	optional
125	*RI*	*9*	*modem->terminal*	*Ring indicator*	optional	optional	optional

Its 4 control modes enable the MR1200 to be used with a large range of terminals making it easily adaptable to particular user applications.

4.3.2. Automatic mode

In this mode, radio modem operation is transparent to the terminal, with only the 3 circuits 103-TD, 104-RD, and 102-SG being used. If necessary circuit 106-CTS may be implemented for handshaking requirements.
Data transmission begins on detection of a specific character.

Rest
Circuit 106-CTS has an ON condition (logic 1), and circuit 109-DCD an OFF condition (logic 0).

Data transmission
When there is data to be sent the terminal transmits it to the MR1200. On reception of the first data byte an attempt is made to access the radio channel (see **§ 4.4**).
If transmission is momentarily inhibited, the MR1200 will delay data output for several seconds.
If radio channel access is refused (see **§4.4**) the data sent by the terminal is lost.
Otherwise, having gained access to the radio channel the MR1200 begins to send data.

Reception of data
When not transmitting data, the MR1200 is permanently listening out for radio channel activity. If data is detected, the modem informs the terminal using the 109-DCD line before passing it on. The terminal cannot refuse communication with the modem.

Termination of radio communication
When data transfer has been concluded - no data awaiting transmission or being received - the MR1200 returns to its rest state after a pre-configured time delay (*tp_rc* parameter).
Communication may, on the other hand, be interrupted by the modem to avoid exceeding the pre-configured maximum transmission time (*tp_emi* parameter), if a value has been set.

Use of circuits 107-DSR and 106-CTS
Circuit 107-DSR normally has an ON condition set during the period of radio data transfer, and an OFF condition set when communication has ended. However, the configuration option exists to set this circuit permanently ON (*ges_dsr* parameter).
Circuit 106-CTS is ON most of the time, being set OFF only when the data transmission buffer overflows. The signal may be used to control data flow from the terminal.

4.3.3. Marked automatic mode

"Marked automatic" mode is simply a variant of automatic mode, the only difference being with transmission control : in this mode, transmission begins on detection of a particular pre-defined character used to end all files to be transmitted.

The ASCII character code is configurable (*mark* parameter).

4.3.4. Direct mode

In direct mode, transmission is controlled using the RTS signal.

Rest
The terminal holds OFF circuit 105-RTS (logic 0). Circuits 106-CTS and 109-DCD are both OFF.

Data transmission
When there is data to be sent, the terminal begins by setting ON the 105-RTS line. The modem then attempts to gain access to the radio channel (see **§ 4.4**).
If transmission is momentarily inhibited, the MR1200 will delay outputting data for several seconds.
Radio channel access may, however, be refused (see **§ 4.4**): in this case, 106-CTS remains OFF, but the terminal can maintain 105-RTS ON in readiness for another attempt.
Having finally obtained access to the radio channel, the MR1200 sets ON line 106-CTS, authorising the terminal to send its data.

Reception of data
When not transmitting data, the MR1200 is permanently listening out for radio channel activity. If data is detected, the modem informs the terminal by setting ON the 109-DCD line, before passing the data on. The terminal cannot refuse communication with the modem..
Line 106-CTS is also set ON enabling the terminal to reply with its data.

Termination of radio communication
The MR1200 returns to its rest state after the pre-configured time delay, once 105-RTS is set OFF AND data transfer has been concluded (parameter *tp_rc*).
Communication may, on the other hand, be interrupted by the modem to avoid exceeding the pre-configured maximum transmission time (*tp_emi* parameter), if a value has been set.

Use of circuits 107-DSR and 106-CTS
Circuit 107-DSR is normally set ON during radio data transmission and set OFF when communication ends. It can, however, be configured to be ON permanently (*ges_dsr* parameter).
Once radio transmission has begun, 107-CTS remains ON and is only set OFF to signal transmission data buffer overflow. The signal can be used to control data flow from the terminal.

4.3.5. V25bis mode

The "V25bis" control mode makes a more extensive use of the serial interface - only 105-RTS is unused - giving the terminal total control over the modem through a set of commands and responses defined by the V25bis standard. Where a number of radio modems are networked, individually addressed data messages can also be sent out.

Each modem is allocated a number between 001 and 255 constituting its network address (*ad_mod* parameter).

Rest
The terminal holds the 108/2-DTR line OFF (logic 0). Circuits 106-CTS and 109-DCD are also OFF.

Dialogue
The terminal opens communication with the MR1200 by setting ON 108/2-DTR. The modem replies by setting ON circuit 106-CTS.
Under these conditions the MR1200 waits for commands and gives responses as per the V25bis standard (CCITT).

Terminal commands		**Modem responses**	
###	< Erroneous command >	INV	Command invalid
PRP**ppp**;**vv...v**	Programme parameter **ppp** with value **vv...v**	VAL	Command accepted
RLP**ppp**	Read parameter **ppp**	LSP**ppp**;**vv...v**	Indicates the value **vv...v** of parameter **ppp**
CRN**aaa**	Transmit command (**aaa** = address of modem receiving the data)	DLC**xx** CFIAB CNX	Call delayed **xx** seconds Radio channel occupied Start of radio transmission
CRN**aaa/ss...s**	Transmit command with a particular CCIR/ZVEI call sequence (**aaa** = address of modem receiving the data, **ss...s** = call sequence)	DLC**xx** CFIAB CFIRT CNX	Call delayed **xx** seconds Radio channel occupied No response from relay Access to channel obtained (Start of radio transmission)
CRN/**ss...s**	CCIR/ZVEI call sequence transmit command (**ss...s** = call sequence)	CNX	Transmission of sequence terminated
	<Modem at rest>	INC	Detection of a radio transmission addressed to the modem
RES0	Reinitialise terminal-modem dialogue	VAL	Reinitialisation carried out
RES1	Reinitialise modem with default parameters	VAL	Reinitialisation carried out

Remarks :

- The symbols **p** or **a** represent ASCII numbers,
- The value **vv...v** of a parameter is given in the form of an ASCII chain ; coding depends on the parameter,
- All terminal commands must comprise ASCII characters and end with a control code [Cr] (Carriage Return), or with the [Cr-Lf] (Carriage Return + Line Feed) combination. The modem terminates its replies with [Cr-Lf],
- A sequence of the form **ss...s** transmitted as part of a CRN command tells the modem which particular radio channel access protocol to use, as well as to activate CCIR/ZVEI tone encoder (the CCIR or ZVEI standard is selected with *st_num* parameter).

Refer to **§ 4.4** for the use of this command.

Call command

When the terminal wishes to send data it sends the modem a call command having the following syntax :

CRN**aaa** [Cr]
or
CRN**aaa**/**ss...s** [Cr] where **aaa** is the network address of the modem receiving the data and **ss...s** is an optional CCIR/ZVEI call sequence.

If the command sent is incorrect the reply is : INV. Otherwise, the MR1200 sets ON 106-CTS, and attempts to access the radio channel (see **§4.4**).

If transmission is momentarily inhibited, the MR1200 sends a delayed call response to the terminal : DLC**xx**, where **xx** is the wait time in seconds.
If access to the channel is refused, the MR1200 replies with the appropriate error message (see **§4.4**): CFIAB or CFIRT.
The terminal can itself cancel the current call command by setting 108/2-DTR to OFF (modem returns to rest state).
When it finally gains access to the channel, the MR1200 lets the terminal know by sending : CNX. Then, 106-CTS is set ON to allow the terminal to send data.

Call reception

When not transmitting, the MR1200 permanently monitors radio channel activity.
If it detects incoming data when in the rest state, it simultaneously sets ON 125-RI and 109-CD. The terminal then has 6 seconds to accept the call by setting ON 108/2-DTR, otherwise any incoming data will be lost.

If the terminal sets ON 108/2-DTR, or if data communication is detected when a dialogue is in progress, the MR1200 sets OFF 125-RI and sends an incoming call message to the terminal : INC. 106-CTS is then set ON to allow the terminal to communicate its data.

End of communication

Communication ends with the timing as configured (*tp_rc* parameter), once there is no more data to send or being received.
Alternatively, the modem may interrupt communication to avoid exceeding the pre-configured maximum transmission time (*tp_emi* parameter), or the terminal may do so by setting OFF 108/2-DTR.
Whatever the case, the MR1200 returns to either a rest or dialogue state depending on the condition of 108/2-DTR.

Use of circuits 107-DSR and 106-CTS

Circuit 107-DSR is normally set ON during radio data transmission and set OFF when communication ends. It can, however, be configured to be ON permanently (*ges_dsr* parameter).
Once radio transmission has begun, 106-CTS remains ON and is only set OFF to signal transmission data buffer overflow. It can be used to control the flow of data from the terminal.

4.4. Radio channel access, & use of the CCIR/ZVEI tone dialler

4.4.1. Introduction

Two elements comprise the MR1200 "tone dialling" system : the radio carrier detection circuitry and a tone encoder conforming to CCIR or ZVEI standards.

This system can be programmed to :

- operate and control carrier activation of a relay conforming to CCIR or ZVEI standards,
- call paging devices conforming to CCIR or ZVEI standards,
- or simply test radio channel availability before transmission in order to avoid collisions,
- .../...

4.4.2. Programming

The choice between CCIR or ZVEI mode is programmable (*st_num* parameter).

The tones to transmit and/or the radio channel access code are defined in a call sequence comprising a chain of up to 10(max.) ASCII characters chosen from the following symbols :

'**0**' to '**9**' '**A**' to '**E**'	transmit corresponding tone. (CCIR or ZVEI mode)
'**:**'	test for channel availability. (no radio carrier wait time - 6s max.)
'**#**'	test relay carrier activation, follows sequence sent if carrier present. (radio carrier present wait time - 6s max.)
'?'	deactivate half duplex then test for presence of relay carrier. Follows sequence sent if carrier absent. (see examples below)
'**>**'	enable transmission
'**!**'	disable transmission (receive)
'**,**'	short pause (100 ms)
'**W**'	long pause (2 s)

Examples:

'**:>**' wait for channel to become free (6s max.),
if channel free - transmit,
if not - report CFIAB failure.

'**:122W33!**' wait for channel to become free(6s max.), if not - report CFIAB failure,
transmit tone sequence '122', then pause for 2s,
transmit tone sequence '33', then return to rest state.

'#>' test for relay carrier (6s max.),
if carrier present -transmit,
if not - report CFIRT failure.

'**?1A22#>**' test for relay carrier,
if absence of carrier detected,
transmit '1A22' ,
test for relay carrier,
if relay carrier present
transmission,
if not - report CFIRT failure,
if not transmit immediately.

4.4.3. Radio relay control

At each switch over to transmission during radio communication the MR1200 CCIR/ZVEI tone dialling system can be activated using a call command.
For this, the *seq_num* parameter simply needs to be programmed with the appropriate call sequence.

By default this parameter is null, the MR1200 using its carrier detect facility to check channel availability each time before it transmits (similar to a '**:>**' sequence).

To activate and control a CCIR or ZVEI relay carrier, the *seq_num* parameter must be programmed with a sequence respecting the following syntax :

'**?nn...n#>**' where **nn...n** is the selective call number of the relay.

CCIR or ZVEI mode is selected by the *st_num* parameter value.

4.4.4. Usage in a V25bis call command

In V25bis mode, the terminal can place a particular call sequence in the call command :

CRN**aaa**/**ss...s** where **aaa** is a radio modem network address
and **ss...s** is the call sequence to use.

This sequence is then only used by the MR1200 at the beginning of transmission. Once communication has been established the call sequence is that programmed in the *seq_num* parameter.

Equally, the terminal can transmit a call sequence for the MR1200 to execute without there being any subsequent data (CCIR or ZVEI pager calling). The syntax is then:

CRN/**ss...s** where **ss...s** is the call sequence to execute.

4.5. Power supply saving (sleep mode)

4.5.1. Operation

The MR1200 is equipped with a power saving system that deactivates particular modem functions during periods of complete inactivity, in order to reduce power consumption to a minimum (300µA). The functions are reactivated when one of the following events occurs :

- terminal sends a command (circuit 108/2-DTR set ON),
- radio channel activity (carrier detected),
- modem first powered, or re-powered after a loss of supply,
- operation of the configuration button.

Note : the sleep mode chosen is set by straps on the circuit board.

4.5.2. Sleep mode

When inactive, the MR1200 drops into **sleep mode** after a configurable time delay of between 1 second and 60 minutes (*att_ina* parameter).

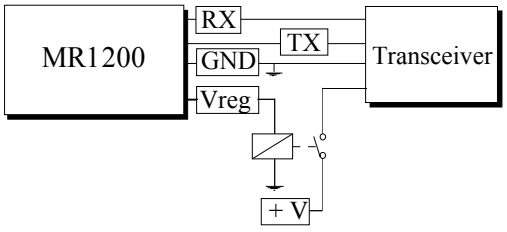
If one of the above events occurs before the time-out, the modem remains awake and the countdown is stopped..

Note : The *att_ina* parameter can be forced to 0 : in this case the power saving feature in inoperative.

4.5.3. Transceiver wake up

The transceiver's power supply can be relay controlled using the MR1200 V_{REG} output.

When the MR1200 drops into sleep mode the V_{REG} signal disconnects the transceiver power supply.



4.5.4. Power up state

When the MR1200 is first powered, or repowered after a loss of supply, it remains awake until after the first radio communication has taken place.

4.5.5. Configuration mode wake up

Operating the configuration push-button switch will cause the modem to wake up so that its different operating parameters can be programmed.
On leaving configuration mode, the modem remains awake until after the first radio communication has taken place.

4.6. Speech use

Where applications use the radio channel for both speech and data communication the MR1200 can be equipped with a microphone/loudspeaker set.
In this case, the *phonie* option must be selected.

When the operator wishes to speak he pushes the transmit-receive button on the set. The MR1200 then suspends all current data communication, and switches the T/R into transmission.
Holding the button down and using the microphone the operator's speech will be transmitted, any request from the terminal to send data being ignored.

Releasing the button switches the T/R back to receive mode, enabling the operator to listen to his correspondent and data communication to be re-established.